SHORTER ARTICLES AND DISCUSSION

REPORT OF THE COMMITTEE ON GENETIC FORM AND NOMENCLATURE

THE American Society of Naturalists at their meeting in 1919 appointed a Committee on Genetic Form and Nomenclature consisting of Drs. S. Wright, G. H. Shull, O. E. White, A. H. Sturtevant and myself as chairman. We were to consider the matter of genetic nomenclature and submit constructive suggestions for standardizing descriptive terms in this subject. "The following report of the committee was submitted to the meeting of the American Naturalists at Chicago, 1920, as a foundation intended to cover the cases of inheritance commonly met with by the majority of experimental workers in genetics. It is submitted in the hope that it may be published to invite discussion as to suggested modifications which would enable it to include particular problems of the scores of investigators in this field. In making such criticisms it is suggested that the primary object of this report be continually borne in mind and that constructive suggestions based on it as a framework are more likely to lead to beneficial results than purely destructive ones. The vast majority of workers in genetics will be concerned with simple enough problems to be covered by the report. Those whose material requires modification of the methods therein suggested will undoubtedly see the justice in attempting to adapt their particular needs to some modification of a system which will meet the needs of the majority."

C. C. LITTLE, *Chairman,*
Committee on Genetic Form and Nomenclature.

In submitting this report your committee desires to call attention to certain matters of general interest in connection with it. It is neither *proposed* nor *supposed* that those now familiar with some characteristic or individual form of genetic nomenclature will necessarily find it desirable to conform with the suggestions contained herein. If they can and will cheerfully do so, so much the better; if not, no intention to dictate is implied in this report.

It is, however, believed that a considerable number of geneticists will agree to the main suggestions of the report, and will thereby form a nucleus to which younger geneticists beginning publication would in a majority of cases join themselves. Thus, after a time, a far more uniform method of publication than now exists would become established.

In order to give such an opportunity, your committee respectfully suggests that this report, if approved by vote of the members present, be published at the earliest convenient time.

1. *The Type.*—In most animals and plants it is convenient to settle on a standard type, preferably the wild type, when this is known. The effects of the various genetic factors are in general to be measured by the departure from type which they bring about. This recommendation involves no real departure from the system now in use by most geneticists.

2. *Series of Allelomorphs.*—A single letter, with a subscript, *if necessary,* is to be assigned to each series of allelomorphs. This letter should, when possible, be chosen so as to give some hint as to the nature of the effects caused by variations in the series in question. The member of each allelomorph series present in the type is to be represented by the symbol for that series, capitalized and with no superscript. Factors dominant over the type are to be represented by the same capitalized symbol as the type, but with appropriate superscripts. Recessives are to be represented by the same symbol in lower case also with appropriate superscripts (*when necessary*). The symbols for the type factors may be omitted in formulæ where convenient. The agouti series in mice A^y, A^1, A, a^n, in which two factors are dominant over the wild gray type and one recessive is an example of the use of symbols. [This series might properly have been given a Y or B symbol in place of the A adopted. Since, however, it is to be thought of in terms of modification of the agouti pattern, the symbol A is chosen.]

3. *Dominance.*—Dominance of genes is recognized to be largely a matter of convenience. Factors may be considered dominant which produce an easily recognized departure from type, when heterozygous.

4. *Superscripts.*—It is suggested that both a literal and a numerical superscript be assigned, *upon the initial description,* to each factor except the type (at least in series of multiple allelomorphs). EITHER SUPERSCRIPT MAY THEREAFTER BE USED ALONE. The numerical superscript shall indicate the estimated

degree of divergence from type, produced by the factor in question in a scale in which 10 is the apparent physiological or visible limit and 0 is the type. Thus A^{10} and a^{10} represent factors which cause deviations to the physiological limit in opposite directions (self yellow and self black) from the type A (agouti). A^4 (light-bellied agouti) represents an estimated deviation between ticked bellied agouti (A) and yellow (A^{10}). *The order of effect is more important than a precise estimate of the degree of effect.* Decimals and numbers beyond 10 may be used whenever necessary, in event of grades not believed physiologically possible. A superscript, once adopted, should not be changed, which also applies to all other symbols. The value of making provision for a system to *indicate the order* of a multiple allelomorph series is clear; the numerical symbols will only be *used* when such a situation is encountered.

5. *Independent Factors.*—Independent series of allelomorphs should be represented by different letters or, if desired, by the same letter with different following numbers. Symbols composed of two or more letters should not be used. It is suggested that factors with more or less similar effects be represented by the same letter with different following numbers, as S1, S2, S3, etc. The same symbol may conveniently be used for factors with more or less similar effects in different animals and plants without implying identity.

6. *Doubtful Factors.*—In case the formula of an individual is not fully known, the uncertain factor may, if desired, be represented by a superscript X (or ?) or the whole symbol may be replaced by a dash. Thus C^x C^x (or $C^?$ $C^?$) means *complete* ignorance of the factor in series C. CC^x, $CC^?$, or C — represents ignorance as to one of the factors in the zygote. If there is partial knowledge, a double (or triple) superscript may be used to indicate the various possibilities. Thus the progeny of the cross CC × c^rc^a may be represented by C c^{ra}, a form which gives more information than C —.

7. *Modifiers.*—The symbol [ ] containing appropriate symbols represents residual heredity of the kind indicated. Thus [S +] is a convenient method of representative + modifiers of the effect produced by the S (Spotting) series of allelomorphs. In a detailed study of a particular group of modifiers, the parenthesis may well contain the grade of effect produced by the modifiers in the case in question. Thus [+ 4.2] and [—2.5] might be used to represent the modifiers of typical hooded rats of grades

$+4.2$ and -2.5. The modifiers of a cross bred may be indicated in some appropriate manner as $[+4.2, -2.5]$.

8. *Linkage* is best represented by the fractional form used by workers on *Drosophila*. The factors are written in the order of linkage, omitting type factors.

COMMITTEE ON GENETIC FORM AND NOMENCLATURE

STANDARDIZED MICROPHOTOGRAPHY

SECOND CONTRIBUTION: THE OBJECT FACTOR

IN my first contribution to the subject of standardized microphotography, published in the *Anatomical Record,* I have pointed out the variables and the methods which I have pursued in treating them. One, or perhaps more correctly a group of variables were, however, left out of consideration quite purposely because of the difficulty in finding for them a standard of permanent value. I have in mind the microscopical section itself or what may be properly called the object factor. The following four elements enter into its composition: (1) the thickness of the section, (2) the light absorption coefficient of the tissue, (3) the relative luminosity of the different stains and (4) the depth or intensity of staining. The second and third of these component elements may be disregarded since experience shows us that exposure is very little influenced by them. There remain, however, the first and fourth, and to determine the influence of these on exposure the following experiments were undertaken.

First of all, to avoid all possible error, slides were chosen of uniform thickness measured with a Ciceri Smiths Patent Micrometer so as to be sure that the distance of the section from the substage condenser should in every case be the same. The cover-glasses were also of uniform thickness. The stomach of a frog preserved in Zenker's fixing fluid was sectioned into series of 5, 10 and 20 micromillimeter thick sections on a Minot microtome and care was taken to have in each case a ribbon of 100 even sections, thus more or less assuring their uniform thickness. The sections were stretched on distilled water heated over a flame and no cement of any kind was used. On one slide three sections of each thickness were placed. On other slides sections only of one kind were placed and their thickness marked in every case by a carborundum pencil.